Guidelines for the Evaluation of Vehicle Exhaust Emission Reduction Technologies

CALIFORNIA ENVIRONMENTAL TECHNOLOGY CERTIFICATION

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CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

California Environmental Technology Certification Program
Guidelines for the Evaluation of
Vehicle Exhaust Emission Reduction Technologies

Introduction: This guideline provides general information and requirements applicable to a vehicle exhaust emission reduction technology participating in the California Environmental Technology Certification Program (CalCert). The Guideline is intended to provide information to the technology proponent that will allow the development of data that can be used in applying to CalCert. Other considerations not specified in this guideline may be required depending on the application and function of the technology. Final data requirements, including the number of vehicle tests, will be determined after the review of the initial data.

CalCert promotes the use of innovative environmental technologies and ensures greater credibility and access to broader markets for certified technologies. Certification is the independent evaluation and confirmation of a technology's environmental performance. CalCert is voluntary and self-supporting. Companies participating in the program pay the costs of evaluating and certifying their technologies.

Pertinent Requirement: California Vehicle Code (VC), Section 27156, requires that the California Air Resources Board (ARB) evaluate after-market add-on components, intended for sale in California, to determine if the effectiveness of the vehicle's pollution control system could be reduced. The manufacturer receives an executive order permitting the sale of the technology, in California, if it is determined that the technology does not cause an increase in vehicular emissions. The evaluation required to receive an executive order can be coordinated with the additional testing required to participate in CalCert. Information on the after-market program is available on the Internet at *www.arb.ca.gov/msprog/aftermkt/aftermkt.htm*.

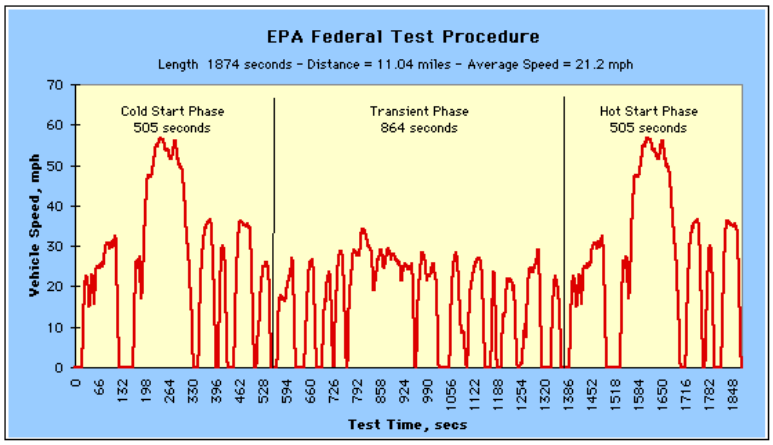
While the executive order permits the sale of the technology in California, it only states that the technology will not reduce the effectiveness of any required motor vehicle pollution control device. A certification from CalCert provides an independent confirmation of the manufacturer's claim of emission reductions beyond those required.

Performance Claims: Claims eligible for consideration are limited to reduction in hydrocarbons (HC, defined as total hydrocarbons, non-methane hydrocarbons, or non-methane organic gases as appropriate), carbon monoxide (CO), carbon dioxide (CO_2), oxides of nitrogen (NO_x), particulate matter (PM), and/or fuel consumption. (To receive certification a technology cannot increase any of the regulated exhaust emissions.)

The performance claim needs to specify the expected emission or fuel consumption reductions and identify the applicable motor vehicle fleet. The benefits of a technology must be clearly stated. An example performance claim is "*Use of the abc technology, on 1995 and older model year light duty vehicle(s), will reduce emissions of CO by xx% and NO_x by yy%.*"

Test Procedures: The ARB uses procedures specified in Title 40, Parts 86 to 94, of the Code of Federal Regulations to evaluate vehicle emissions. Information on the federal vehicle emission test procedures and emission limits are available on the U.S. EPA's Office of Transportation and Air Quality web site at *www.epa.gov/oms* and at the Unites States Government Printing Office web site at www.gpo.gov/nara/cfr/index.html. Please note, that California emission limits are lower (more stringent) than the federal emission limits. California vehicle emission limits are available on the ARB's Low-Emission Vehicle Program web site at *www.arb.ca.gov/msprog/levprog/levprog.htm*.

Light and medium duty vehicles:
The official test used by the ARB to determine emissions from light and medium duty vehicles is the federal Constant Volume Sampling procedure, established in 1975, often called the "CVS75". The CVS75 procedure includes measuring exhaust emissions collected in three bags representing; a cold start phase, a stabilized transient phase, and a hot start phase. The CVS75 is pictured graphically in the image to the right.



For light and medium duty vehicles it is necessary to perform each test configuration (baseline and modified) in triplicate. The third test may be omitted if the difference between the first and second exhaust emission value is less than 5% for HC and NO_x and less then 10% for CO and CO_2. Calculation of the percent variability shall be by comparison with the first test performed. The test vehicle cannot be modified or repaired between repeat tests.

For the initial evaluation of fuel consumption claims the federal procedure titled *Highway Fuel Economy Driving Schedule* (HFEDS) should be used. The HFEDS can be run supplemental to the CVS75 procedure. Additional procedures representing heavy acceleration and air conditioning usage such as the federal *US06* and the *SC03* driving schedules could be required.

Data collected from inspection and maintenance (I/M) or Smog Check stations will not be accepted for evaluation. The Smog Check program is intended to determine if a vehicle is well maintained and not designed to quantify changes in emissions. In addition, the Smog Check program does not test a vehicle under typical driving conditions.

Heavy-duty vehicles: The official test procedures used by the ARB to determine emissions from heavy-duty vehicles, using chassis dynamometer testing, are the *Heavy-duty Urban Dynamometer Driving Schedule* (UDDS) and/or the New York Bus Cycle (NYBC). The UDDS is intended to represent urban, inter-city driving, whereas the NYBC is intended to represent stop and go or idling conditions. For engine dynamometer testing, the *Heavy-duty Transient Cycle* procedure is used. The procedure utilized should represent the driving conditions applicable to the use of the technology. The same test cycle needs to be used for the baseline and modified configuration testing.

For heavy-duty vehicles it is necessary to perform one cold-start and three hot-starts, of the selected test cycle, for each test configuration (baseline and modified).

Data collected from the Heavy-duty Vehicle Inspection and the Heavy-duty Periodic Inspection Programs will not be accepted for evaluation. These programs are intended to reduce excessive smoke emissions and to help ensure that heavy-duty vehicle are kept well maintained and tamper-free; and are not designed to quantify changes in emissions.

Data Requirements: When applying to CalCert, manufacturers need to include exhaust emission data from two vehicles. Typically, a certification evaluation will require valid data from at least six vehicles. The certification evaluation will include the most popular, worst case (highest emitters), and the most recent applicable model year vehicles. If applicable, the vehicle fleet must be selected from various manufacturers.

The tested vehicles must be representative of the fleet to which the technology will be marketed and certified for use in California. Prior to initiating testing, a vehicle must be set to its manufacturer's tune-up specifications and in good working order. Any repairs performed after the beginning of testing shall invalidate all testing and the test sequence shall be repeated. The total number of vehicles to be tested will depend on the size and variability of the emission reduction and the variability of the applicable vehicle fleet.

All test data obtained in support of the technology must be submitted, including vehicle preparation activities, printouts from emission measurements, driver traces, results declared void or invalid, and a report explaining the test results and procedures. Test data generated before a client is formally accepted into CalCert or VC27156 is considered preliminary and may not be accepted.

Test Considerations:

- Prior to initiating testing, a vehicle must be set to its manufacturer's tune-up specifications and in good working order.

- Any repairs or maintenance performed after the beginning of testing could invalidate all testing and the test sequence shall be repeated. Any maintenance or repairs performed need to be documented.

- The testing needs to be conducted using either the Certification Fuel (Indolene for gasoline applications) or fuel certified and approved for use in California. The same batch of fuel should be used for baseline and modified configuration testing. The laboratory needs to perform fuel analysis prior to baseline and modified configuration testing.

- A new or rebuilt engine needs to have accumulated a minimum of 4,000 miles, or for heavy-duty vehicles, 125 hours of operation, in order to ensure that the vehicle emission system has stabilized.

- The testing laboratory must install the device. Any vehicle conditioning required by the technology must be conducted and documented by the testing laboratory or an independent entity. The same conditioning must be conducted prior to the baseline and modified (technology installed) configuration tests.

- The testing laboratory must document the engine settings every time a vehicle comes in for testing.

- Technologies applicable to 1996 model year and newer could require additional testing to determine if On-Board Diagnostics II functioning is affected or if evaporative emissions could be increased.

- Vehicle operating parameters (i.e. fuel flow, exhaust back pressure, ...) that could be affected by the technology need to be evaluated and documented.

- If the technology requires adjustments of original vehicle manufacturer specifications (e.g., timing, fuel-air mixture, idle speed...), a set of triplicate tests, with only the adjustments, needs to be conducted in addition to the baseline and modified configuration tests.

- Data from durability testing will be required if, upon evaluation of the technology, it appears that the durability of the vehicle emission control system could be affected, or the technology is subject to durability considerations.

- Technologies that contain material that are likely to be in contact with the fuel or exhaust stream could require additional information and testing to determine if the technology or use of the technology could cause an increase in overall emissions of toxics.